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STUDY THE EFFECT OF DIABETES MELLITUS (TYPE 1 AND 2) ON COMPLETE BLOOD COUNT IN DIABETIC PATIENTS

Aamir M. Abed AL-GHAREEBAWI[1]

University of Thi-Qar, Iraq

Safaa Hussein ALI

University of Thi-Qar, Iraq

Abstract

this study is amid to discover the use of complete blood count (CBC) parameters to be helpful tool in follow up Diabetes Mellitus (DM) control in diabetic patients and to determine possible (CBC) parameters changes as indictor in discover and regulation of DM. 30 men (35-50 years old) selected as 10 non-diabetic, 10 type 1 and 10 type 2 DM depending on random sugar test and case history of each subject in research, blood drown from each subject and read CBC parameters to all specimens. The results appeared that there was significant elevation in MCHC, MPV and P-LCR in type 2 DM and significant decrease in WBC, RBC, HCT% and RDW-SD in diabetic patients when compared to non-diabetic men. The other parameters did not show any significant change among groups. Blood elements parameters can be use as indicator to treat and follow up DM complications.

Keywords: Diabetes Mellitus, Type 1 DM, Type 2 DM, CBC and Men.

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[1] amir.m@utq.edu.iq, https://orcid.org/0000-0002-1637-8089

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Introduction:

Diabetes Mellitus ((DM)) is disorder of metabolism characterized by an extreme high blood sugar resulting deformity of insulin action, insulin secretion or both. The incurable hyperglycemia of DM consequences is various complications like renal failure, weak eyesight, cardiac infraction, nervousness and vascular disease **(1).** The abnormalities of metabolism of carbohydrate, fat and protein refer to inadequate response of insulin to cells and tissues of the body as result hyperinsulinaemia **(2).** The World Health Organization (WHO) published first globally recognized typing in 1980. There are two mjor kinds of (DM) are as Type 1 which is Insulin-dependent diabetes mellitus (IDDM) and Type 2 DM which is Noninsulin-dependent diabetes mellitus (NIDDM). Diabetes Miletus can happen with specific symptoms like dry mouth, polyuria, fatigue, exhaustion, weight loss and blurring of focused vision . Most of the symptoms are not awful, and might not even appear **(3)**.

Type 1 diabetes mellitus (T1DM) is resulted by different types of environmental factors interfering with genetic predisposition causing Autoimmune destruction to beta cells of pancreas **(4;5).** The (T1DM) starting occurs in early life and children smitten with developing of macrovascular and microvascular complexity and diseases of cardiovascular later as a diabetes complication. The factors which are elevation the vascular complications risks in patients undergo from T1DM are Hyperglycemia, dyslipidemia, inflammation, and stress **(6;7)**. Those complications for long times results premature mortality in these patients **(8).**

Complete Blood Counts (CBC) may be useful as pretty indexes and independent predictors for different macrovascular and microvascular disorders concerning to dysfunction of endothelium and inflammation. Changed level of various hematological indices like RBC, WBC, functions of platelet and morphology have been appeared to be straightway association to diabetes mellitus **(4, 5,6,9,10,11)** and metabolic syndrome in the grown up patients due to (CBC) close relationship to various components of metabolic syndrome, involving insulin resistance **(12**). The type 2 diabetes Millets (T2DM) is a fundamental public health proplem in which happening has been increasing dramatically worldwide **(13)**. Inappropriate control of glucose of blood in diabetic patients is the main key for the incidence of both micro- and macro-vascular problems (**14)**.

Increased level of glucose of blood in T2DM contributes to indices of blood cells disturbance **(15)**. Good control of blood glucose is the major recommendation to prevent the complications development of DM. It has been supposed that early adjustment of glycaemia may deplete pathological mechanisms that are linked and happened as result of hyperglycemia like elevation oxidative stress and proteins glycation of cells and lipids **(16).** So, it is important to fulfill a gradual optimization of HbA1c range between 6.5- 7%, recommended range as a long-term way to management the decrease of incidence of micro and macrovascular complexity in people with DM **(17).**

The monitoring diabetes mellitus patients by laboratory tests occur by glucose level in plasma (random sample), glycated proteins, urine sugar, fructosamine, glycated hemoglobin (HbA1c), urinary proteins like micro-albuminuria and protein-uria, status of lipid parameters, kidney function C-peptide and insulin, (**18**). Hemoglobin A1c is range glycemic amount for the last (2–3) months in diabetic subjects. Depend on the HbA1c amount, an evaluation of glucose mean (eAG) amount can be estimated **(19) (20).** Parameters gained by hematologic analysis can equip prudence into differ that occur in indices of blood elements. Hematological parameters analysis could help in the following-up of the beginning or increase of degenerative problems in diabetic patients **(21).**

The conclusion of current study suppose that some of CBC parameters will be helpful tool in monitoring and following DM control of diabetic patients. The current study aim to define possible (CBC) parameters changes as indictor in discover DM regulation.

Materials and Methods

Blood is drawn from 30 men (35-50 years old), 10 non-diabetic, 10 type 1 and 10 type 2 DM. The diagnosis of DM done by use random sugar test and case history. The tourniquet (Arth Al-Rafidan, Iraq) is tied around the upper arm so that it presses moderately on the hand so that the vein protrudes and ask the patient to form a fist with his hand so that the veins are more prominent. Insert the needle of plastic syringe (Kontam, China) into the vein at an angle of 30 degrees or less. Remove the tourniquet after collecting a sufficient amount of blood. Pull the needle gently and apply pressure gently. On the site, using clean cotton (Arth Al-Rafidan, Iraq), with the arm extended and raised, and it is necessary not to bend the arm because this causes hematoma. Put the withdrawn blood in the EDTA tube (derma, Italia) and slowly shake the tube to mix the blood well with anticoagulant.

We put whole blood in a CBC device (MED, India). We make sure that there is a paper in the printer attached to the CBC device and makes the device pipette reach to the tube end and the blood absorbed correctly with big button pressed behind the pipette until the device sound heard which telling us that the collection of blood process is completed in the pipette, the tube comes out quickly and the device persist to calculate components of blood for about one minute.

Statistical analysis

Statistical analysis done by use One-Way ANOVA method **(22)**.

Results

Table (1): Show the count of RBC, WBC and HGB concentration

	WBC 10^9/L	RBC 10^{12}/L	HGB g/L
Control	10.92±1.40 **a**	5.280±0.248 **a**	14.045±1.121
Type 1 DM	7.03±2.17 **b**	4.709±0.461 **b**	12.909±1.105
Type 2 DM	11.54±3.14 **a**	4.796±0.401 **b**	13.190±1.679
LSD	3.88	0.483	N.S

The mean differences are significant with (p≤0.05).

Different letters refer to significant (p£0.05) differences among the groups.

Figure (1): Show the count of RBC, WBC and HGB concentration

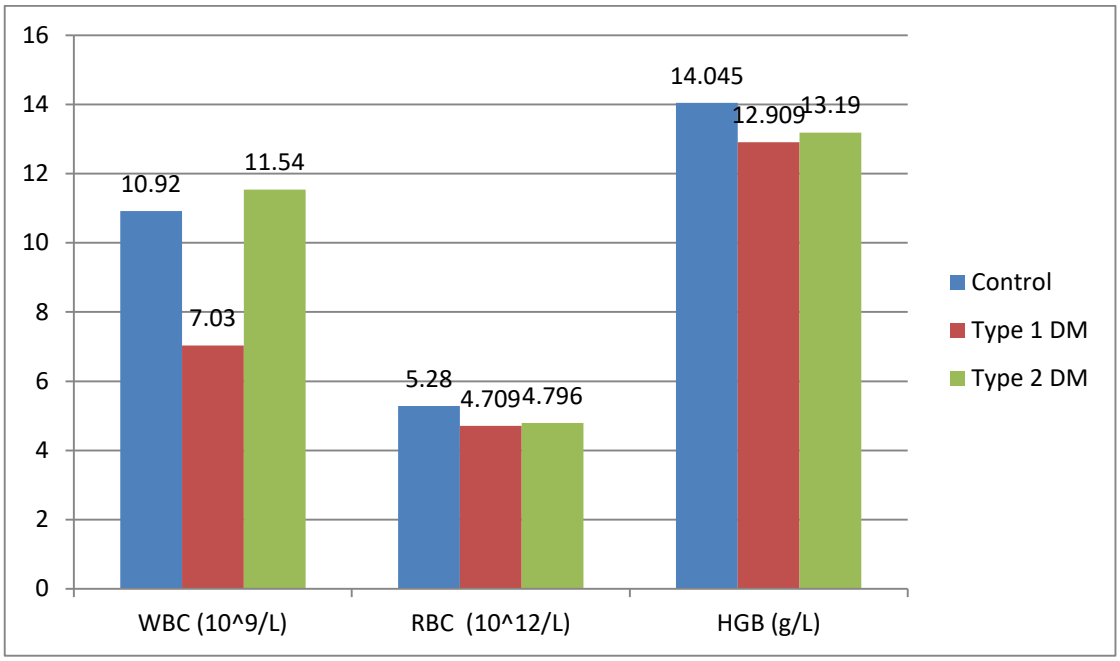


Table (1) appeared significant (p≤0.05) reduction in count of WBC in Type 1 DM when compared to control and Type 2 DM but there was non-significant (p>0.05) difference between non-diabetic patients group and Type 2 DM groups. RBC count estimation revealed significant (p≤0.05) reduction in Type 1 and 2 DM groups as comparing to control group with no significance (p>0.05) change between Type 1 and Type 2 groups. Hemoglobin concentration appeared non significant (p>0.05) differences between studied groups as shown in table and figure (1).

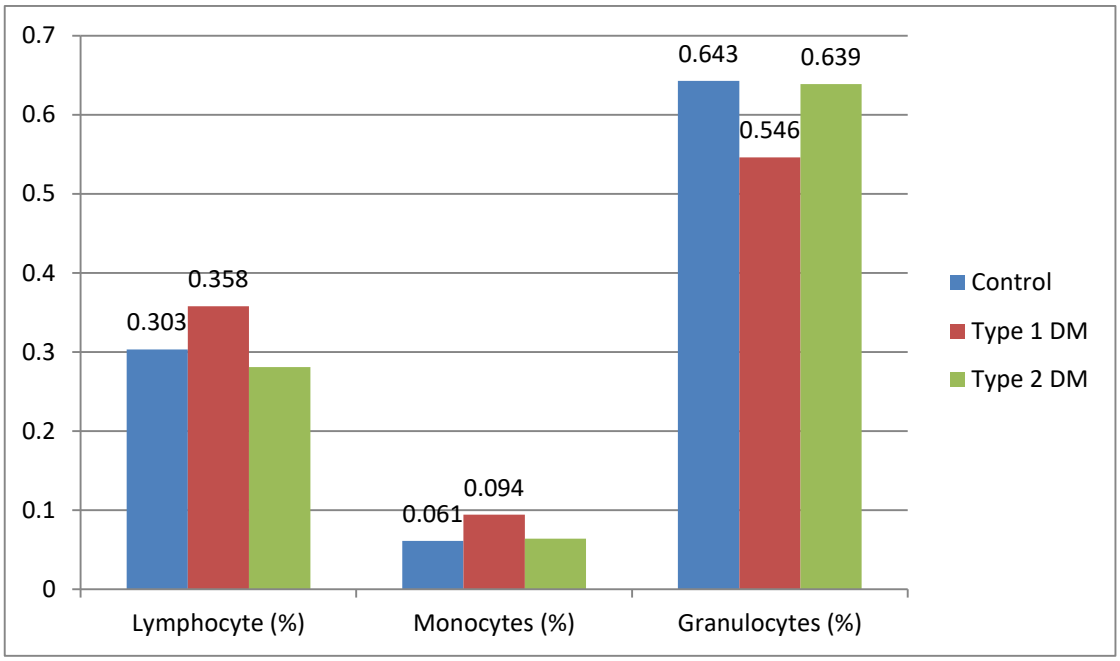
Table (2): Show the Percent of lymphocytes, Monocytes and Granulocytes

	Lymphocytes %	Monocytes %	Granulocytes %
Control	0.303±0.03	0.061±0.018	0.643±0.052
Type 1 DM	0.358±0.142	0.094±0.061	0.546±0.149
Type 2 DM	0.281±0.149	0.064±0.034	0.639±0.170
LSD	N.S	N.S	N.S

The mean differences are significant with (p≤0.05).

v Different letters refer to significant (p£0.05) differences among the groups.

Figure (2): Show the Percent of lymphocytes, Monocytes and Granulocytes



In table (2) the percentage of Lymphocyte, Monocytes and Granulocytes did not show any significant (p>0.05) changes among studied groups as values appeared in table and figure (2).

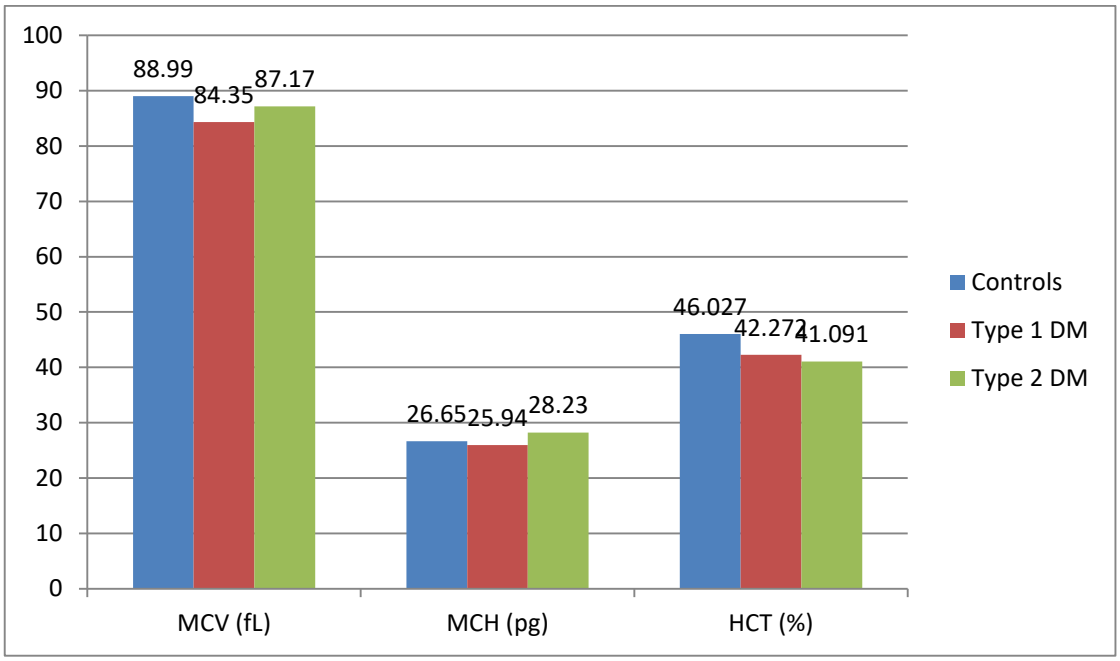
Table (3): Show the value of MCV, MCH and HCT perecentage

	MCV fL	MCH pg	HCT %
Control	88.99±3.05	26.65±2.22	46.027±1.927 **a**
Type 1 DM	84.35±9.85	25.94±4.07	42.272±3.379 **b**
Type 2 DM	87.17±8.65	28.23±3.06	41.091±4.715 **b**
LSD	N.S	N.S	3.754

The mean differences are significant with (p≤0.05).

v Different letters refer to significant (p£0.05) differences among the groups.

Figure (3): Show the value of MCV, MCH and HCT percentage



The values of MCV and MCH was not changed significantly (p>0.05) among all groups but there was significant (p≤0.05) decrease found in Type 1 and 2 DM groups in HCT percentage in comparison to group of control with non significant (p>0.05) differences between studied groups, as shown in table and figure (3).

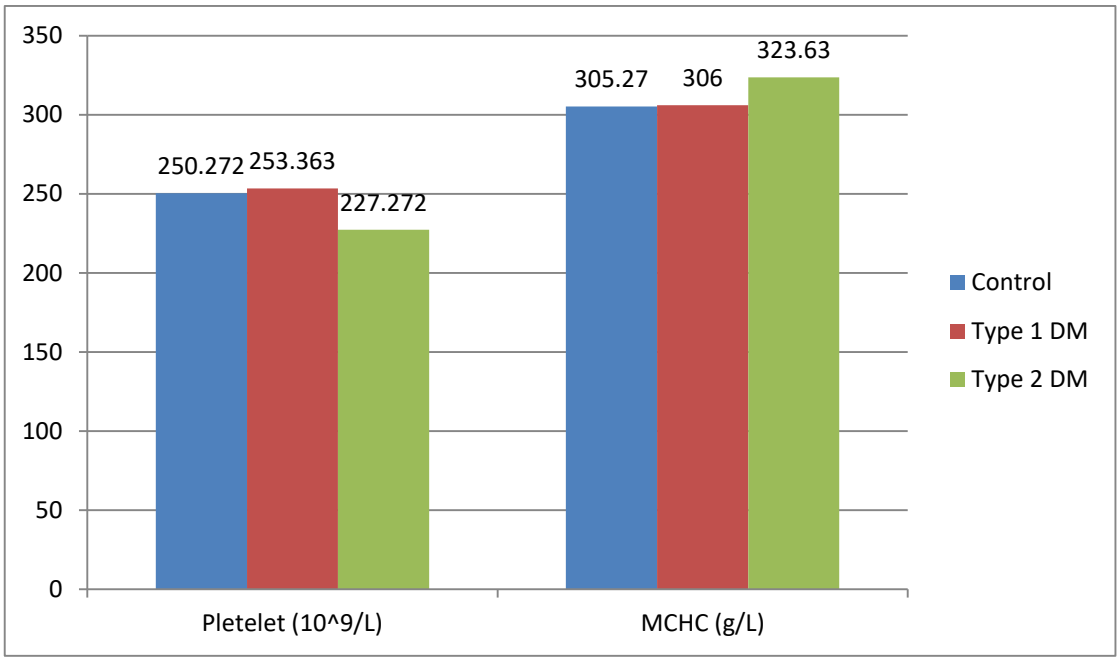
Table (4): Show the count of Platelets and MCHC Value

	PLT 10^9/L	MCHC g/L
Control	250.272±51.635	305.27±10.08 **b**
Type 1 DM	253.363±14.193	306.00±17.60 **b**
Type 2 DM	227.272±42.185	323.63±7.48 **a**
LSD	N.S	17.63

The mean differences are significant with (p≤0.05).

v Different letters refer to significant (p≤0.05) differences among the groups.

Figure (4): Show the count of Platelets and MCHC Value



Platelet count did not offer any significant changes ($p>0.05$) among all groups. At same time, the MCHC value revealed significant ($p\leq0.05$) increase in Type 2 DM group in comparison to control and Type 1 DM with non-significant differences between them as shown in table and figure (4).

Table (5): Show the values of (RDW-CV), (RDW-SD), (MPV) and (P-LCR)

	RDW-CV	RDW-SD (fL)	MPV (fL)	P-LCR
control	0.146±0.013	44.55±3.89 **a**	9.41±0.25 **ab**	0.250±0.018 **a**
Type 1 DM	0.137±0.016	39.01±2.82 **b**	8.57±0.55 **b**	0.195±0.048 **b**
Type 2 DM	0.149±0.013	40.83±3.11 **b**	9.99±1.62 **a**	0.277±0.030 **a**
LSD	N.S	3.71	1.41	0.054

The mean differences are significant with ($p\leq0.05$).

v Different letters refer to significant (p£0.05) differences among the groups.

Figure (5): Show the values of RDW-CV and P-LCR

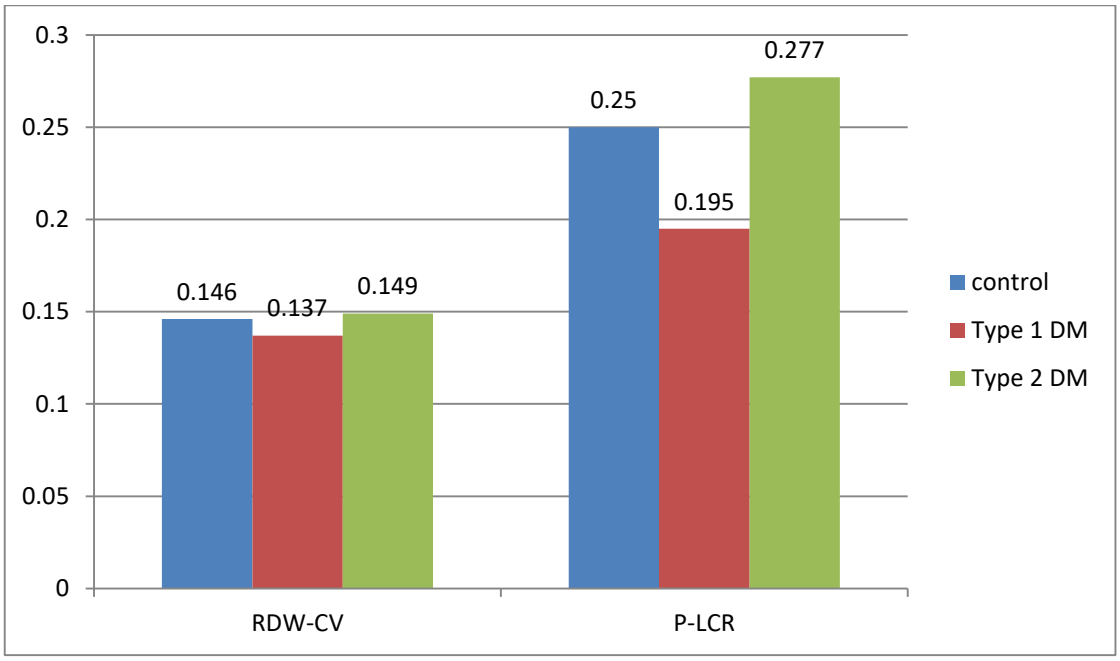
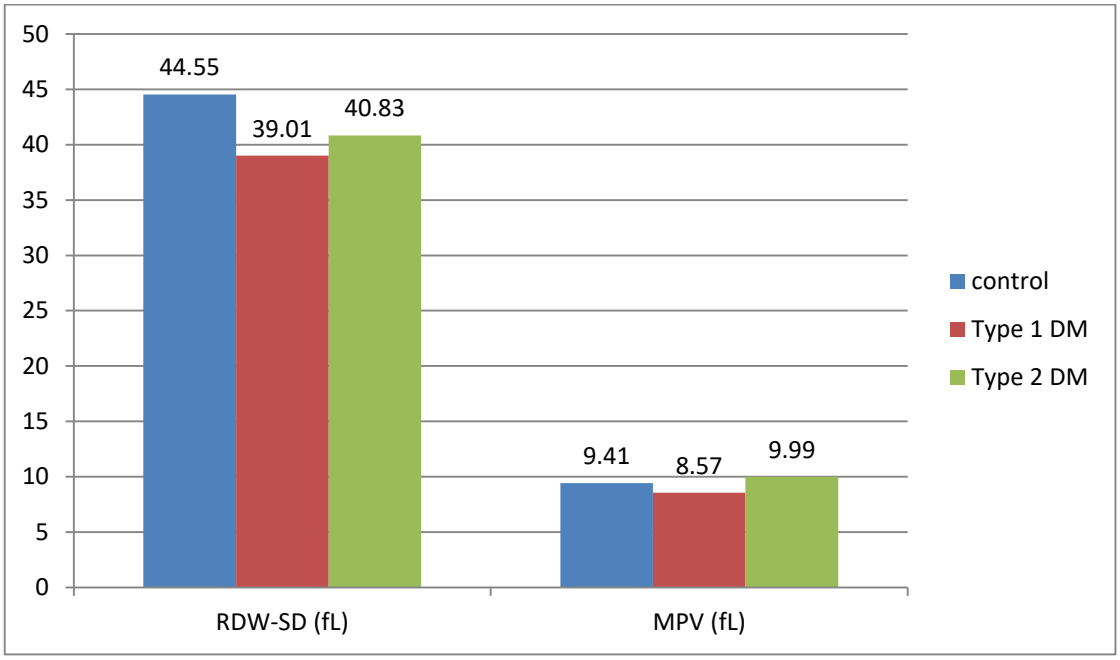


Figure (6): Show the values of RDW-SD and MPV



Finally, RDW-CV value had not any significant ($p>0.05$) change among all studied groups. The significant ($p\leq0.05$) reduction appeared in estimation of RDW-SD in both (T1DM) and (T2DM) groups with comparison to control group with no significant ($p>0.05$) difference between them. Also, non-significant ($p>0.05$) change appeared between control group and both DM groups when calculate the MPV values but the Type 2 DM appeared significant ($p\leq0.05$) increase in comparison to Type 1 DM. P-LCR values revealed significant ($p\leq0.05$) reduction in (T1DM) in comparison with control and (T2DM) groups. On other hand, non significant ($p>0.05$) difference between Type 2 DM and control groups as appeared in table (5) and figures (5) and (6).

Discussion

The results of current study revealed that significant decrease in total WBC count in Type 1 DM as comparison with control group and this results agree with **(23)** who said that the neutrophils are main type of WBC involved in the type 1 DM pathogensis. So, WBC count changed at most lead to changes in count of neutrophil. In addition, (T1DM) patients had increased (WBC), mostly numbers of neutrophil more than the control group**,** and elevated counts of neutrophil were mentioned to correlate with an augmented cardiovascular complixity risk **(24)**. However, most recent researches revealed that neutrophil and WBC number consequently were reduced in (T1DM) patients and healthy autoantibody positive patients which might be concerned to cell specific autoimmunity (**25; 26; 27 and 28).** Reduced countof neutrophil mediates a reduction in total (WBC) count **(23)**.

Suzana *et al.*, (2021) found that significant reduction in RBC count , HCT percent and HGB concentration in Type 1 DM children as compared with healthy peers as results of current study. This agreement may be due to possibility of development of anemia in the Type 1 DM group**(23).**

Irace *et al.*, (2011) found that HGB concentration and HCT% were significantly decreased in patients with retinopathy as comparison to patients with no microvascular proplems, retinopathy, he supposed that structural changes of RBC membrane, altration of electric charge of surface or accumulation of RBC, that could cause shorter lifespan of erythrocytes. In addition to thromboembolic disorders, the platelet indices are related with inflammation and disease action of inflammation. Increase platelet aggregation is the common alteration in platelet behavior in DM and hyper aggregation of platelets was reported in patients suffer from both (T1DM) and (T2DM)**(29) (30) (31). Jaman *et al.*, (2017)** suggested that association between mean platelet volume (MPV) and platelet count accompanied by HbA1c**(32).**

The normal value of the RDW-CV is (11.5- 14.5) percent and elevated values due to increase of cells size. High RDW occur as result of elevated level of anisocytosis which is concerning to degradation and distortion of process of erythropoiesis **(33).** There was non significant increase in RDW-CV in T2DM in our results which agrre with **(32)**. Increasing in MCH and MCHC due to anemia occurrence in diabetic mellitus because elevation of enzymatic glycosylation of red blood cells proteins of membrane, which occur with hyperglycemia. The glycosylated proteins oxidation of membrane and hyperglycemic in DM patients lead to an increase in lipid peroxides production leading to RBCs hemolysis or DM may lead to secondary disorder as anemia **(32)**.

Red blood cells distribution width (RDW) is important parameter of the standard complete blood count (CBC) and use in measurement in the erythrocytes size. It is calculated by (automated hematology analyzers) and show the extent of size of RBC **(33)**.

RDW is a inflammatory prognosis and marker in diabetics people (**34**) (**35)**. The connection between DM and red blood cells distribution width has been examined by (**36**) who reported that B-type natriuretic peptide (BNP) related with RDW in DM poeple with Heart failure. **Engstrom *et al.* (2014)** reported that reduced RDW was related to elevated developing risk of DM. reduced RDW was also associated with increased waist circumference, insulin, triglycerides and glucose levels **(35)**. On the opposed opinion, RDW was positively and significantly related to (HbA1c) corresponding an elevation in HbA1c of 01.10% per SD elevation of RDW. Also, **(37)** showed the connection between DM and RDW complexities (macrovascular and microvascular) in a people of 2.497 diabetic patients and deduced that increased RDW were related to elevated probability of develop of vascular complexity in heart failure (HF) and myocardial infarction (MI).

The T2DM patient can be monitored by RDW evaluation in (CBC). Also, elevated RDW reflect of elevated HbA1c in (T2DM). So, it may useful in evaluating of DM**(38).** Diabetic

patients, particularly type 2 DM, have been appeared elevated reactivity of platelet. This has been indicate that both (insulin deficiency and insulin resistance). Insulin has been appeared to antagonize the action of platelet agonists as adenosine di-phosphate, adrenalin, collagen and platelet activating factor. **(39).** An elevation in MPV has been recorded in people suffered from metabolic syndrome, DM and stroke. **(40)** who reported that MPV was increase significantly in DM subjects and who supposed that abnormal morphology of platelets are related to elevated risk of vascular problems in DM patients. **(41)(42)**. **Sonali *et al.*, (2011)** reported that patients with proliferative diabetic retinopathy had increased MPV range when comparing with controls**(43).**

Many studies (**44)(45)(46)(47)(48)** shown higher (PDW, MPV, P-LCR and platelet number) with diseases endothelium dysfunction like diabetes. Current study shown significant decrease in P-LCR in T1DM as compared with non diabetic and T2DM groups with no statistical differences between control and T2DM groups, this result agree with **(49)**who documented that parameters of platelets PDW, MPV and P-LCR appeared reduced in the non-diabetic subjects group while the highest value in the uncontrolled T1DM patients. This supposed that well controlled diabetic people have normal morphology of platelets like healthy children.

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